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Requirements-Based Restructuring of Army Military Occupational Specialties

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REQUIREMENTS-BASED RESTRUCTURING OF ARMY MILITARY OCCUPATIONAL SPECIALTIES

EXECUTIVE SUMMARY

Requirement:

In 1988, the U.S. Army Signal Center requested that the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) initiate a focused examination of Military Occupational Specialty (MOS) restructuring issues in the Army's Signal Branch and evaluate methods to facilitate the analysis and design of MOS and Career Management Fields (CMF). In a resulting research note (Akman and Haught, 1990), two types of MOS restructuring were identified. One, the subject of that report, is operations-based restructuring that deals with MOS merger actions undertaken by the personnel proponent under guidance from the U.S. Army Personnel Integration Center (USAPIC). The other is requirements-based restructuring that occurs during the system acquisition process and aims to identify potentially new or modified MOS required to support the operations and maintenance of new equipment. Results of this latter process are a major catalyst in the operations-based restructuring performed by the personnel proponent.

The purpose of this research note is to describe requirements-based MOS restructuring and to identify ways in which the current process may be made more systematic and quantitative. This discussion complements the earlier report. Together the reports provide a comprehensive assessment of the way in which MOS are currently restructured and ways in which the processes may be improved.

Procedure:

This research note first describes the Army system acquisition process in which manpower and personnel integration (MANPRINT) and requirements-based MOS restructuring occurs; this description sets a broad procedural baseline. Second, the MANPRINT process is described, setting a more narrow focus in which to address restructuring. Third, the requirements-based MOS restructuring process is discussed; this is accomplished in terms of nine analytical steps that generally might occur. Finally, the research note assesses the way in which requirements-based restructuring occurs and identifies six initiatives for its improvement.

Findings:

Research reveals that requirements-based MOS restructuring occurs as part of MANPRINT when existing MOS cannot satisfy the requirements stemming from new equipment. Although current regulatory guidance, policies, and handbooks provide an abundance of guidance on performing MANPRINT analyses, requirements-based MOS restructuring is not explicitly addressed, nor are its steps formally identified or documented.

The current process can be made systematic and more quantitative using at least six initiatives addressed in this report:

1. System Architecture for Requirements-Based MOS Restructuring
2. MOS Restructuring Assessment Aid
3. Requirements-Based Tradeoff Analysis Method
4. MOS Impact Analysis Method
5. Requirements-Based MOS Restructuring Handbook
6. MOS Action Plan Generator

Utilization of Findings:

The research initiatives identified in this report may be used to make requirements-based MOS restructuring systematic and more quantitative. Because the current process does not formally exist, the development of a MANPRINT handbook documenting the analytical steps represents an important first action. Using this as a baseline, pursuit of any one or a combination of the other initiatives would contribute substantially to improving current practices and procedures.

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REQUIREMENTS-BASED RESTRUCTURING OF ARMY MILITARY OCCUPATIONAL SPECIALTIES

Introduction

Restructuring military occupational specialties (MOS) may be required for a variety of reasons. Among these are (1) changes in Army policy and doctrine, such as warfighting scenarios or modifications in unit deployment and capabilities, (2) revisions in organizational structures such as tables of organization and equipment (TOE) and tables of distribution and allowance (TDA), and (3) introduction of new equipment or technology into the Army's force structure.

All or any combination of these restructuring requirements may cause serious manpower, personnel, and training (MPT) issues. These issues must be identified and assessed by the Army's doctrine, training, and personnel communities as early in the force development process as possible in order to ensure the affordability, supportability, and stability of the Army's MOS structures.

The purpose of this report is to establish a procedural baseline for requirements-based MOS restructuring. The baseline is drawn in terms of the existing policies, practices, and methods used by Army combat developers (CBTDEV), materiel developers (MATDEV), training developers, and personnel proponents to determine MOS structure needs.

This document will provide a foundation for identifying and developing methods to improve requirements-based MOS restructuring at the functional branch proponent or training center level. In support of this document, research was performed on how existing Department of Defense (DoD) guidance, Army regulations (ARs), guidebooks, and working environments that influence requirements-based MOS restructuring.

Regardless of the cause, MPT concerns and the general approaches for addressing them are similar, whether the triggering event is a new system acquisition, new doctrine, new organization or some other change. This research note, for the purposes of illustration, has been written in the framework of a new equipment acquisition. However, if soldier requirements are revised, MOS restructuring may be required and the analytical process would be substantially the same.

Background

Army combat developers, materiel developers, training developers, and personnel proponents are required to assess the impacts of new or revised doctrine, organizations, or equipment

systems on the Army's MPT resources. In terms of new equipment system acquisitions, Army Regulation (AR) 602-2, Manpower and Personnel Integration (MANPRINT) in the Materiel Acquisition Process, contains the regulatory guidance. The regulation outlines responsibilities and provides a process to incorporate soldier (operators, maintainers, and supporters) capabilities and limitations as a factor so that an optimum system performance is achieved.

In order to assess MPT impacts, a series of analytical processes must be accomplished. For example, manpower and training requirements must be determined and personnel supportability and affordability issues must also be analyzed and documented. During these analysis processes, critical decisions are made in terms of the type and number of MOS needed, grade structure requirements of each MOS, and the tasks, skills, and knowledge required to support revisions in doctrine, organizations, and new system or technology introductions. Based upon these analytical processes, requirements-based restructuring needs are delineated. Restructuring needs may range from no requirement to revising MOS tasks, eliminating tasks, adding tasks, merging tasks with another MOS, or creating a new MOS.

In the research note Review and Analysis of the MOS Restructuring Problem, Akman and Haught (1990), MOS restructuring was found to occur in two different scenarios. As illustrated in Figure 1, the first of these restructuring processes begins early in the development cycle of any new equipment item under consideration for Army procurement. This "requirements-based," or Type 1, MOS restructuring begins in the research and development phase of equipment acquisition and continues through the final documentation of the equipment item in TOEs.

Type 1 MOS restructuring originates during the development of the Operational and Organizational (O&O) Plan. This plan provides information on manpower, personnel, and training based on the examination of the equipment system and an assessment based on the skills required to operate and maintain the system. The O&O indicates if an existing MOS can perform the required system tasks either as currently structured or if revised. If no MOS that can perform the system tasks exists, the O&O also documents the need for a new MOS. These MOS options may be changed as system requirements become better defined.

Assessment and recommendation of required changes to existing MOS structures are driven by the development of the Basis of Issue Plan (BOIP) and the Qualitative and Quantitative Personnel Requirements Information (QQPRI). The BOIP and QQPRI provide recommended personnel changes to support new equipment fielding such as the need for new or revised training, duty position requirements, and the need to develop a new or revised MOS.

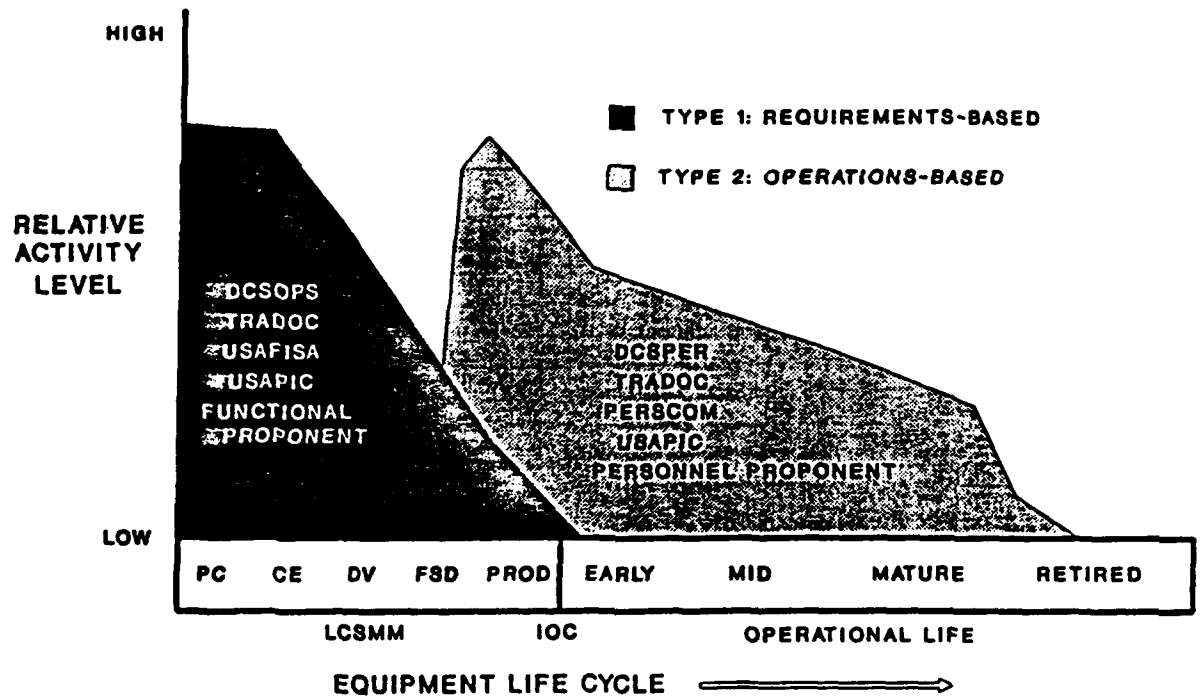

Figure 1. Types of MOS restructuring.

Operations-based, or Type 2, MOS restructuring is an extension of the requirements-related MOS restructuring. Once requirements have been determined through the Type 1 restructuring process and the focus changes to supporting those requirements in terms of personnel.

Type 1 and Type 2 restructuring interface and overlap at many points. However, the scope of the analysis for Type 1 restructuring is broader inasmuch as the convenience of working with pre-defined occupational structures no longer exists. Instead, the analyst must use the results of his task analysis to structure new occupations. Furthermore, the analysis must be extended to integrate these new occupations into the existing MOS structure.

This research report places emphasis on identifying opportunities for improving the capability of determining needs, analyzing impacts, and executing Type 1 MOS restructuring decisions earlier in order to provide the proper lead time needed to fully develop a personnel support system that is capable of accommodating the fielding of new or revised equipment systems.

Overview of Report

This research note consist of four sections. The first section provides a general overview of the Army's system acquisition process and provides a baseline for identifying MANPRINT processes that impact on requirements-based MOS restructuring.

The second section discusses MANPRINT in the system acquisition process, delineates MANPRINT domains, and identifies the domains that have the greatest impact on requirements-based MOS restructuring.

The third section examines current requirements-based MOS restructuring methods at the proponent school level. This examination includes (1) a description of the relationships and responsibilities of the various agencies involved in MANPRINT planning, (2) a description of the requirements-based analytical process, and (3) examples of requirements-based restructuring decisions.

The final section assesses the baseline with respect to identification of the analytical areas which provide the greatest opportunity for research and methodological improvements.

The Army's System Acquisition Process

The purpose of this section is to provide an overview of the system acquisition process as it functions within the Army. The process as defined here includes not only the acquisition of major new systems and major modifications of existing systems but also includes non-major programs. The rationale for this is that the same principles and safeguards used with regard to major systems also apply to non-major systems. The only differences between a major and non-major program are the degree of detail reflected in documentation and the level of the decision making authority. The policy bases for Army system acquisitions, phases of the acquisition process, decision points, primary participants, and principal documentation are presented in this section.

This section is designed to serve as a point of departure or baseline for determining which MANPRINT domains have the greatest impact on requirements-based MOS restructuring. Therefore, this description is presented from the perspective of MANPRINT planning and places the greatest emphasis on the acquisition process areas with MANPRINT significance.

Regulatory Guidance and Policy

DoD and the Army have produced guidance specifically addressing the system acquisition process. This guidance has enhanced the role of MANPRINT planning as an integral part of acquiring new Army systems.

Three documents contain the principal DoD policy guidance for new system acquisitions. They are DoD Directive (DoDD) 5000.1, Major System Acquisition, DoD Instruction (DoDI) 5000.2, Major System Acquisition Procedures, and DoDD 5000.53, Manpower, Personnel, Training, and Safety (MPTS) in the Defense System Acquisition Program.

DoDD 5000.1 establishes the procedures for the acquisition of major systems and describes the phases and milestones of the system acquisition process. The document assigns specific responsibilities for the acquisition of major systems, governs procedures of the Defense Acquisition Board (DAB), and describes the actions to be taken and specifies the documents to be prepared in support of each milestone.

DoDI 5000.2 augments DoDD 5000.1 by appointing members and advisors to the DAB, and by identifying and specifying formats for DAB-level program documentation. DoDI 5000.2 also provides the instruction that establishes the procedures to implement DoDD 5000.1. This instruction reflects the emphasis of integrating manpower, personnel, and training planning into the early phases

of the system acquisition process and requires increasing detail in each following phase.

DoDI 5000.2 requires that new systems be designed to minimize manpower in terms of number of people, grades, specialties, and skill levels needed for operations, maintenance, and support. Analysis and documentation projecting skill level availability are to be included at program initiation as constraints in system design. The estimates will be refined as system development progresses to form the basis for crew station and maintenance design, personnel and training requirements, training devices and simulator design, and other planning related to manpower and personnel.

DoDD 5000.53 establishes the policy, assigns responsibilities, and prescribes procedures for the integration of manpower, personnel, training and safety (MPTS) considerations throughout the system acquisition process. The policy is designed to enhance system performance by improving all aspects of the human and machine interface. The directive requires that determinations be made as to whether a system being procured or modified can be effectively operated, maintained, and supported given the human capability and limitation constraints of the forces that can be recruited, trained, and retained.

Army policy for the implementation of DoD guidance is contained primarily in two regulations. AR 70-1, Systems Acquisition Policy and Procedures and AR 602-2, MANPRINT. AR 70-1 establishes policies, procedures, documentation requirements, and reviews for Army acquisition programs. The regulation also emphasizes front-end planning to implement efficient acquisition, and establishes policies and procedures for type classification of Army materiel.

AR 602-2 prescribes policies and procedures, and assigns responsibilities for the MANPRINT program in the Department of the Army (DA). The regulation describes MANPRINT as an "umbrella concept" which encompasses human factors engineering, manpower, personnel, training, health hazard assessment, and system safety. MANPRINT focuses on influencing system design and associated support requirements so that Army systems can be operated and maintained in the most cost effective and safest manner consistent with manpower structure, personnel aptitude and skill, and training constraints of the Army.

System Acquisition in the Army

System acquisition in the Army is a complex series of activities, documentation, events, and decision points designed to meet the goal of acquiring equipment systems which can effectively meet mission requirements while controlling expenditures in terms of both dollars and human resource

requirements. The phases of the process provide the means of obtaining that goal. Following is an overview of each phase. Table 1 provides a list of the principal acquisition activities by phase.

Mission area analysis phase. Mission area analysis (MAA) begins whenever a need for development of a new capability is identified. MAA is a CBTDEV assessment of the capability of a force within a particular battlefield or functional area. MAA is a collection of information gained from many separate studies and analysis into a single document. To facilitate the detailed analyses of the Army's ability to execute wartime missions, the Army's overall battlefield concept is broken down into mission areas such as logistics, air defense, combat, combat support, and so on. These mission areas serve as a baseline for measuring the capabilities of the force programmed in the program objective memorandum (POM).

When the MAA process reveals a battlefield, or functional area capability issue, the CBTDEV and MATDEV jointly assess the best methods to satisfy the need. If a determination is made that the acquisition of a new or improved equipment system is required to support the need, a mission needs statement (MNS) is drafted along with an O&O plan.

The CBTDEV and MATDEV will also generate an initial System MANPRINT Management Plan (SMMP). The SMMP becomes the sole source document from which the MANPRINT aspects of the new equipment system acquisition requirement is planned, managed, and evaluated. The SMMP is updated as changes occur in the emerging equipment system and provides an audit trail with which to track MANPRINT issues throughout the development and fielding of the system.

Concept exploration and definition phase. Approval of the O&O plan and MNS is also an endorsement for a new program start and provides authority to budget for a new program. This mission need approval constitutes the concept exploration and definition phase and may be formalized with an Acquisition Decision Memorandum (ADM).

At the core of the concept exploration and definition phase is the identification of acquisition options, selection of the best option, and the development of an overall acquisition strategy. Project affordability, supportability, and priority are examined along with other areas such as MANPRINT, technical feasibility testing (TFT), and operational feasibility testing (OFT).

Critical issues that affect development and supportability are identified. Tasking and coordination are initiated with other agencies concerning related support such as training

Table 1

Principal Acquisition Activities

MISSION AREA ANALYSIS	CONCEPT EXPLORATION AND DEFINITION	CONCEPT DEMONSTRATION AND VALIDATION	FULL-SCALE DEVELOPMENT	FULL-RATE PRODUCTION AND INITIAL DEPLOYMENT
Draft O&O Plan and Mission Needs Statement	Perform Technical Feasibility Testing	Perform Developmental Testing	Perform Preproduction Testing	Perform Logistics Readiness Support Review
Develop Manpower Constraints	Perform Operational Feasibility Testing	Establish Manpower Goals and Thresholds	Operational Testing and Evaluation	Perform Production Qualification Testing
Begin Manpower Concept Development	Conduct Task and Human Factors and Skill	Refine Manpower Estimates	Perform Live Fire Testing and Evaluation (Combat Systems)	Perform Follow-on Test and Evaluation
Evaluate MOS Requirements	Estimate Personnel Funding	Continue Trade-off Analysis	Validate Manpower Goals and Thresholds	Field Fully Trained and Qualified Operator, Maintainer and Supporter
	Examine MOS Alternatives	Develop and Refine MOS Structure	Refine Manpower Estimates	
	Produce Initial Manpower Estimates	Perform Manpower Sensitivity Analysis	Continue Trade-off Analysis	
	Conduct Trade-off Analysis	Develop Training Requirements	Refine Training Requirements	
		Develop Training Plan	Refine Training Plans	

devices and test equipment which must be developed in conjunction with the major system.

Demonstration and validation phase. During this phase, system design or designs are tested and improved. Prototypes are built and extensive operational testing and evaluation are conducted. These activities feature the steps necessary to verify preliminary engineering, accomplish planning, and analyze tradeoff recommendations that consider technical, operational, MANPRINT, affordability, and supportability problems, and validate the selected concept. The recommended system design and acquisition plan are then reviewed by (1) the DAB if for a joint service system, (2) the Army System Acquisition Review Council (ASARC) if for a major Army system, or (3) through an In process review (IPR) if the system is not considered major. Approval to begin the next phase marks the full-scale development go-ahead.

Full-scale development phase (FSD). During FSD, the approved system design, which includes all necessary training devices, threat simulators, and test equipment, is used to develop a full-scale prototype for final test and evaluation. The MATDEV conducts readiness-to-test reviews prior to government conducted system-level technical and user tests. The support infrastructure for the new system is also finalized and acquisition of long lead time resources begins.

By the end of the FSD, the design is proven and all prerequisites for procurement and fielding are complete. The program is then reviewed to ensure all objectives were met and all constraints observed. The FSD may also include a low rate initial production (LRIP) to verify production capability and provide the system assets necessary to conduct preproduction and production qualification, live fire, and operational testing. A favorable full-scale development phase decision indicates the beginning of full production.

Full-rate production and initial deployment phase. This phase is characterized by sustaining rate production and initial fielding of the equipment system along with the system's support equipment, publications, and services. The system is produced and fielded in accordance with an approved schedule. Support resources such as training sites and maintenance facilities are activated, and maintenance and operational support personnel are assigned to meet new system availabilities. While there is no established end point for this phase, the primary focus is successful deployment and initial operational capability until the normal logistics and maintenance support operations can take over.

Participating Agencies

Numerous agencies have responsibilities in the system acquisition process and are well documented in AR 70-1 as well as other regulatory guidance, directives, and guidebooks. This subsection provides an overview of the principal agencies and their responsibilities in the acquisition process.

Army Secretariat. The Army Secretariat provides policy guidance and sets standards for the acquisition of Army equipment systems. The secretariat has responsibility to (1) develop and publish budget policy and budget preparation instructions for equipment system procurement, (2) monitor the MANPRINT program and ensure that MPT requirements to support a new system are integrated into the long-range planning process, and (3) oversee logistical acceptability and supportability of all equipment systems.

Army staff agencies. Army staff agencies have a prominent role in the acquisition of Army equipment. Staff responsibilities include (1) develop policy and guidance for equipment system requirements and combat development programs, (2) establish and validate Army priorities for acquisition programs, (3) develop modernization plans and coordinate force modernization activities, (4) conduct force integration analysis and assess supportability and affordability of structure, manpower, facilities, training, equipment, and dollars for new system acquisitions, (5) ensure logistical acceptability and supportability of equipment systems, and (6) develop policy and ensure that MANPRINT is integrated into Army equipment system acquisitions and product improvements.

Major Army commands. Army commands that exercise materiel, training, and combat development responsibilities play a pivotal role in the system acquisition process. Their responsibilities include (1) provide program management for technology based programs, (2) establish policy and provide equipment and mission area integration, (3) conduct technical tests (TT) and support user testing (UT), (4) formulate doctrine, concepts, organization, and equipment requirements, (5) coordinate and integrate the combat developments efforts of the Army, and (6) ensure training programs are in place to support the fielding of Army equipment systems.

Army acquisition executives and project managers. Army acquisition executives (AAE) and project managers (PM) are also principal participants in the system acquisition process. As a group, they have responsibility to (1) administer acquisition programs in accordance with DoD policies and guidelines, (2) establish overall guidance for the policy and program aspects of Army acquisitions, and (3) provide centralized management of acquisition programs.

MANPRINT Joint Working Group (MJWG). The MJWG manages MANPRINT issues during the equipment system acquisition process. The MJWG provides oversight to ensure that the MANPRINT process is carried out in a timely basis and that the products are meaningful. The MJWG normally consists of representatives from the Directorate of Combat Developments, Directorate of Training and Doctrine, Directorate of Evaluation and Standardization, Safety Office, TRADOC System Manager, Personnel Proponent, Human Engineering Laboratory, and the Army Research Institute, among others.

Program Management Documentation

Numerous reports, plans, and memoranda are used to assist in the system acquisition process. Controlled by a variety of policies and directives, system acquisition documentation is employed as a mechanism to identify what must be accomplished and the approach to be utilized to (1) facilitate progress assessment, (2) provide a sufficient basis for decision making, and (3) provide an audit trail of requirements, actions, decisions, and rationale for the overall acquisition program.

Program management documentation can generally be divided into the categories of requirements documents, decision documents, and program documents. Requirements documents are normally initiated by the CBTDEV with input from the MATDEV, training developer, personnel proponent, and logistician, among others. Requirements documents include O&O plans, mission needs statements, operational needs statements, required operational capability (ROC), and the Manpower Estimate Report (MER) (used in major procurements only), as well as other documents.

Decision documents are those requiring specific approval by the program decision authority. These documents establish the basis and boundaries of program decisions and formally document the outcome. The primary system acquisition decision document is the acquisition decision memorandum (ADM) which documents approval of the O&O plan and mission needs statement, and initiates authority to budget for a new program.

Program documents are used to initiate, coordinate, and implement the overall acquisition strategy. Program documents include among others, acquisition plans (AP), acquisition strategies (AS), cost estimates, BOIP, and competitive prototyping strategies. Program documents address all information relevant to the goals, constraints, life-cycle costs, performance capability, requirements, and trade-offs impacting a system acquisition.

The Relationship Between MANPRINT and Requirements-Based MOS Restructuring

In order to determine the relationships between MANPRINT and requirements-based MOS restructuring, it is important to first have an understanding of the primary characteristics of manpower and personnel integration. This section provides an overview of the MANPRINT activities undertaken by participants in the acquisition process and how those activities relate or impact on MOS restructuring.

This section is divided into four subsections. First is an overview of MANPRINT in the Army's system acquisition process. Second, the six MANPRINT domains are presented with a discussion of each. Third, key domains of the MANPRINT planning process associated with acquisition-related human resource planning are discussed, and the relationships of the domains to requirements-based MOS restructuring presented. Finally, current and evolving MANPRINT tools and products are reviewed.

MANPRINT in the System Acquisition Process

The philosophy of MANPRINT in the acquisition process is focused on optimum system performance under battlefield conditions which includes consideration of both soldier and equipment capability. The MANPRINT process is an option oriented rather than objective oriented process designed to provide decision makers with information upon which to make trade-offs and decisions in areas such as training, quality and distribution of personnel, manpower requirements, and training costs.

MANPRINT in the preconcept exploration phase. MANPRINT for an equipment system is initiated when a decision is made that meeting a doctrinal or training need requires the improvement or development of equipment. During this phase, the human elements in relation to manpower capabilities, aptitudes, and skills available, forecasted training capabilities, and personnel supportability are considered.

Additionally, research is conducted to determine training support requirements, resolve critical training issues, and ensure that training strategies are adequate and attainable. All MANPRINT significant findings and issues are incorporated in the O&O plans and in subsequent documentation as applicable (e.g., Required Operational Capabilities document, Test and Evaluation Master Plan, Request for Proposal). MANPRINT analysis and activities accomplished during this phase provide a baseline from which technical approach alternatives and their resulting MANPRINT implications can be compared.

MANPRINT in the concept exploration phase. During this phase, MANPRINT requirements and constraints are established and

included in requirements documents, solicitation documents, and the appropriate technical and management plans. Additionally, analysis is performed and estimates of manpower, personnel, and training cost including projected cost of recruiting and retaining soldiers with required aptitudes are explicitly considered in terms of cost effectiveness and selection of the best technical approach for supporting the doctrine or training need.

Also in this phase, critical MANPRINT data are collected and evaluated on equipment systems with a significant human interface. The data are collected to determine whether the proposed system concept can deliver the expected performance capabilities using personnel with no greater aptitudes, skills, or training than planned. Proper application of MANPRINT methodologies during this phase can provide the greatest opportunity for influencing system design and cost containment. Where the conceptual equipment system is a radical departure from current systems, predecessor data may not be available or applicable. In this case, actions are taken to ensure MANPRINT issues are emphasized in subsequent phases.

MANPRINT in the demonstration and validation phase. In this phase, MANPRINT standards, measures, testing issues, and criteria are developed and provided to the testing community. In addition, data in support of the initial BOIP and QQPRI are developed.

During the demonstration and validation phase, the requirement to conduct a continuing training requirement analysis (TRA) is documented in the requirements documents. This information includes development of an initial training strategy for the user based on tentative identification, allocation, and sequencing of tasks, and the user's role in operating, maintaining, and supporting the equipment.

MANPRINT in the full-scale development phase. Activities in this phase center around specifying and recording in requirements documents the human engineering characteristics, soldier characteristics, and manpower, personnel, and training considerations distinctive to the equipment system. Also, MANPRINT data to support the BOIP and QQPRI are updated during this phase.

MANPRINT in the production and deployment phase. All MANPRINT actions should be completed and the equipment system ready for fielding. New equipment training and institutional training should be on-line to provide training for personnel to operate, maintain, and support the equipment system. Manpower authorizations should be documented to ensure that personnel with the required skills and abilities are available to fill the operational requirements. Any follow-on or unresolved major

MANPRINT issues are addressed and resolved. The equipment support package, including test measurement and diagnostic equipment (TMDE), tool kits, lesson plans, and technical manuals should be in place before the first unit is equipped.

MANPRINT Domains

MANPRINT refers to the extensive management and technical effort required to ensure system effectiveness by continuous integration into equipment development and acquisition all relevant information involving the domains of human factors engineering, manpower, personnel, training, system safety, and health hazards. The key to understanding MANPRINT is knowledge of what the domains are and their impact upon soldier performance.

Manpower. Manpower addresses the affordability of the Army's military and civilian resources in terms of manpower requirements and authorizations. Manpower requirements can be defined as the total number of human resources needed to perform a function. Authorizations, on the other hand, are defined as the total number of resources that can be afforded to perform a function.

Manpower in the MANPRINT process includes the analysis of the force structure impacts in terms of number of spaces, MOSs, grades, and capabilities required to support a new equipment system being contemplated or acquired. The analysis also requires a determination of the manpower changes that will result from the addition of a new equipment system, a comparison of the manpower requirements associated with a new equipment system versus the requirements of the system being replaced (if applicable), and an evaluation of impacts on the total manpower ceilings of the Army. The question of manpower affordability must be answered prior to full-scale development of an Army system.

Soldier performance considerations in terms of manpower consist of determining if a new equipment system can be operated and maintained at the current force structure levels or, if not, determining if the system can be operated and maintained at a reduced manning level and calculating the decline in system performance.

Personnel. From a MANPRINT viewpoint, personnel is determining the capability of the Army's personnel system to provide the qualified personnel needed to operate, maintain, and support new equipment systems. Personnel analysis is an assessment of (1) quality in terms of aptitudes, capabilities, and experience needed by soldiers to complete training and successfully operate, maintain, or support the new equipment, (2) the quality of soldier needed versus those soldiers projected to be available,

and (3) the capability to support any new requirements within the priorities and constraints established by the Army.

Soldier performance considerations of personnel lay the ground work for integrating the aptitudes and abilities required of soldiers into the total systems design. By doing so, the soldier-machine interface and system performance can be optimized.

Training. Training in the MANPRINT process requires consideration of the cost and time needed to transfer the enabling knowledge and skills to Army personnel for the operation and maintenance of new equipment systems. These considerations include both the ability of the Army's training centers to provide the training required by a new system and the long term impacts on the organizations receiving new equipment in terms of accomplishing sustainment training.

Training is a critical segment of the overall system acquisition process. Therefore, training considerations must ensure that (1) new system engineering designs can be supported from a training standpoint, (2) realistic training strategies are developed and documented, and (3) resource requirements are determined in order for training to occur in time to support fielding of the equipment system.

From the aspect of soldier performance, training focuses on two primary objectives. First is determining the aptitudes or abilities required of the soldier to ensure successful training. Second is defining the knowledge that the Army must impart to the soldier upon enlistment and throughout the soldier's career. Together, soldier aptitudes and knowledges result in skills which impact the soldier's contribution to the overall system effectiveness.

Human factors engineering (HFE). Human factors engineering in MANPRINT requires analysis of the human-machine interface with the goal of maximizing the ability of the soldier to perform as an integral part of the overall equipment system. This MANPRINT process is accomplished to (1) optimize the human-machine interface by eliminating design induced soldier error and (2) minimize the impacts of poor equipment design on the levels of manpower, personnel and training required to operate, maintain, and support an item of new equipment.

System safety. The system safety domain involves the application of engineering and management principles to enhance safety of both the equipment system and the personnel who operate and maintain the equipment. System safety centers on enhancing the ability of the soldier to effectively accomplish assigned missions without unnecessary risk of injury or death, or damage to the equipment.

Health hazards. Health hazards refers to the employment of biomedical and psychological knowledge and principles to eliminate or control risks to the health of personnel who operate, maintain, and support new equipment systems. Although this MANPRINT domain is closely affiliated with safety, the major thrust is on eliminating any condition inherent in the operation or maintenance of a system that can cause death, injury, or illness to the soldier.

None of the MANPRINT domains should be considered a stand-alone entity as each domain is bounded and linked to the others. Therefore, any changes in one domain usually comprise impacts on one or more additional domains. For example, a major increase in the technical complexity of an equipment system could impact (1) manpower requirements by increasing the need for the number of maintainers, (2) personnel quality by raising aptitude and skill requirements, and (3) training by increasing the duration of in-house or sustainment training courses.

MANPRINT and Requirements-Based MOS Restructuring

Throughout the system acquisition process, application of MANPRINT by acquisition participants ensures (1) manpower requirements are quantified and documented as being consistent with peacetime constraints, readiness requirements, and wartime goals, (2) training and training support resources are in place and functioning in time to support the new system, and (3) personnel resources required for operation, maintenance, and support of a new system are trained and on-site when the system is fielded.

Each of the six MANPRINT domains is related to requirements-based MOS restructuring. However, as depicted in Figure 2, the domains that comprise the most direct relationship are manpower, personnel, and training. MPT planning drives requirements-based restructuring by identifying career management field (CMF) issues, MOS issues, and Army constraints that cannot be mitigated by changing the design of new equipment, reducing manning levels, reducing system capability, or employing other MPT methods. If a new or modified equipment system represents MPT increases, the proponent (normally the combat developer) must find tradeoffs to pay for the increases from within the functional area (Armor, Ordnance, Infantry, etc.) for which the equipment system is being developed.

Requirements-based MOS restructuring is an analysis process that supports MOS selection, structuring decisions, and constraints resolution. The requirements-based restructuring process considers CMF and MOS specific issues such as the need for new or revised training, MOS task aggregation, duty position requirements, and the need to develop a new or revised MOS.

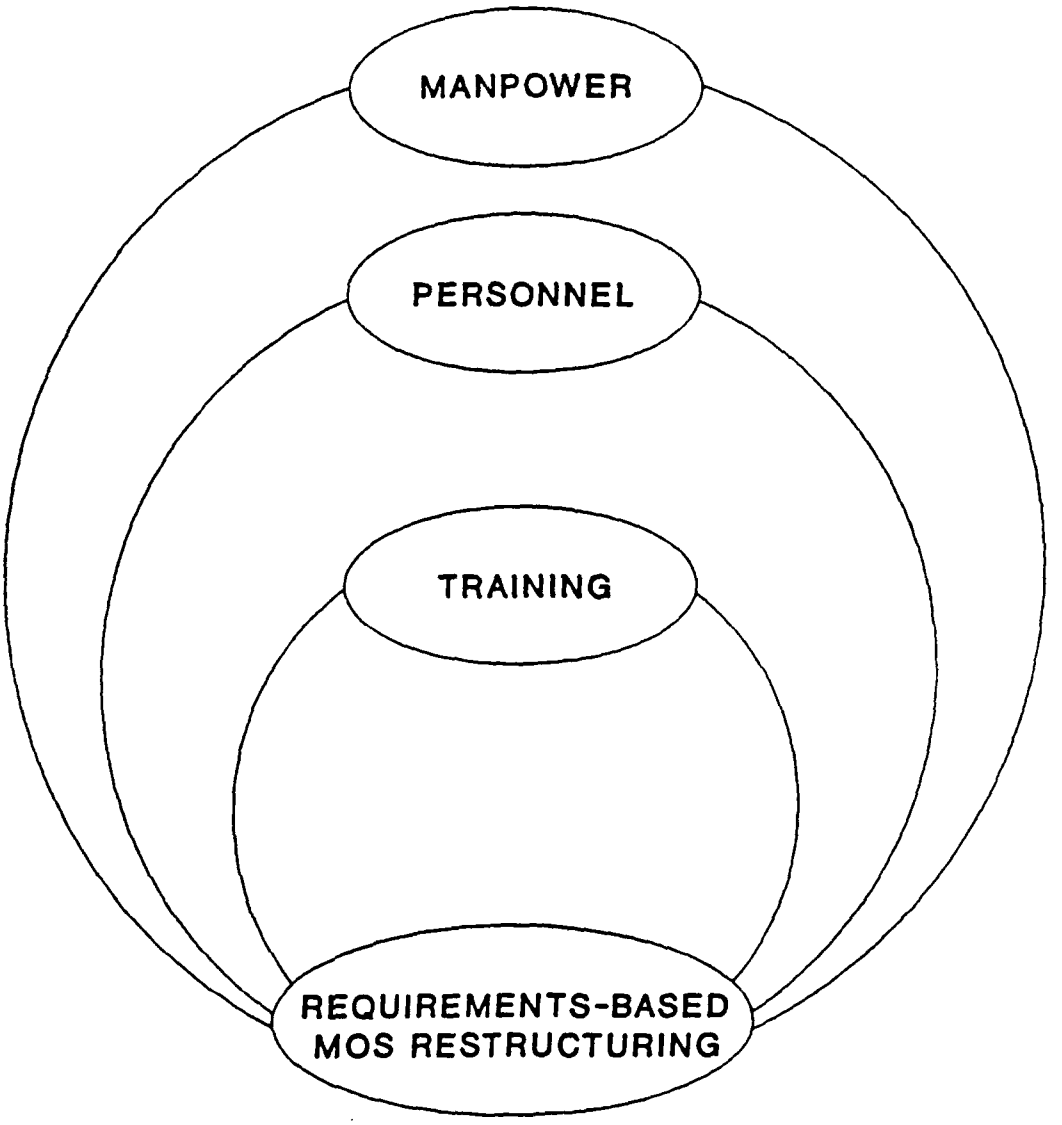

Figure 2. Relation of MPT to MOS restructuring.

As depicted in Figure 3, MOS restructuring is a multi-dimensional process that requires complex series of decisions and tradeoffs. Some of the factors that are addressed in tradeoff decisions include:

1. Training impacts
2. Personnel characteristics
3. Force structure requirements
4. Equipment design
5. Personnel resources
6. Manpower resources
7. Task structures.

Training impacts. Requirements and resources for training must be assessed by the equipment system proponent throughout the equipment acquisition process. As development of training concepts and requirements needed to support the conceptual system evolves, the proponent must continually monitor these requirements and assess their impacts on training courses, student load, training device needs, and instructor requirements, as well as other training resources.

Personnel characteristics. Personnel characteristics concerns the quality of personnel required by a new equipment system. The quality of individuals that the Army can attract each year is limited. Therefore, the proponent must constantly appraise quality needs and ensure that personnel quality requirements are in line with established constraints. If not, a distribution of quality or manning shortfall may result.

Force structure. The proponent determines and documents the quantity of personnel by MOS and grade needed to operate, maintain, and support a new equipment system. If increases beyond current MOS grade structure constraints are required, the proponent identifies force structure tradeoffs as necessary to prevent unsupportable demands at system fielding.

Equipment design. Poor equipment design can have adverse impacts on MPT requirements and, by extension, on MOS structuring decisions. The proponent should ensure that manpower and force structure impacts of equipment design are minimized from an MOS structuring perspective. The proponent must also ensure that appropriate goals and constraints in terms of the system's manpower requirements are established so that available resources drive equipment design and not vice versa.

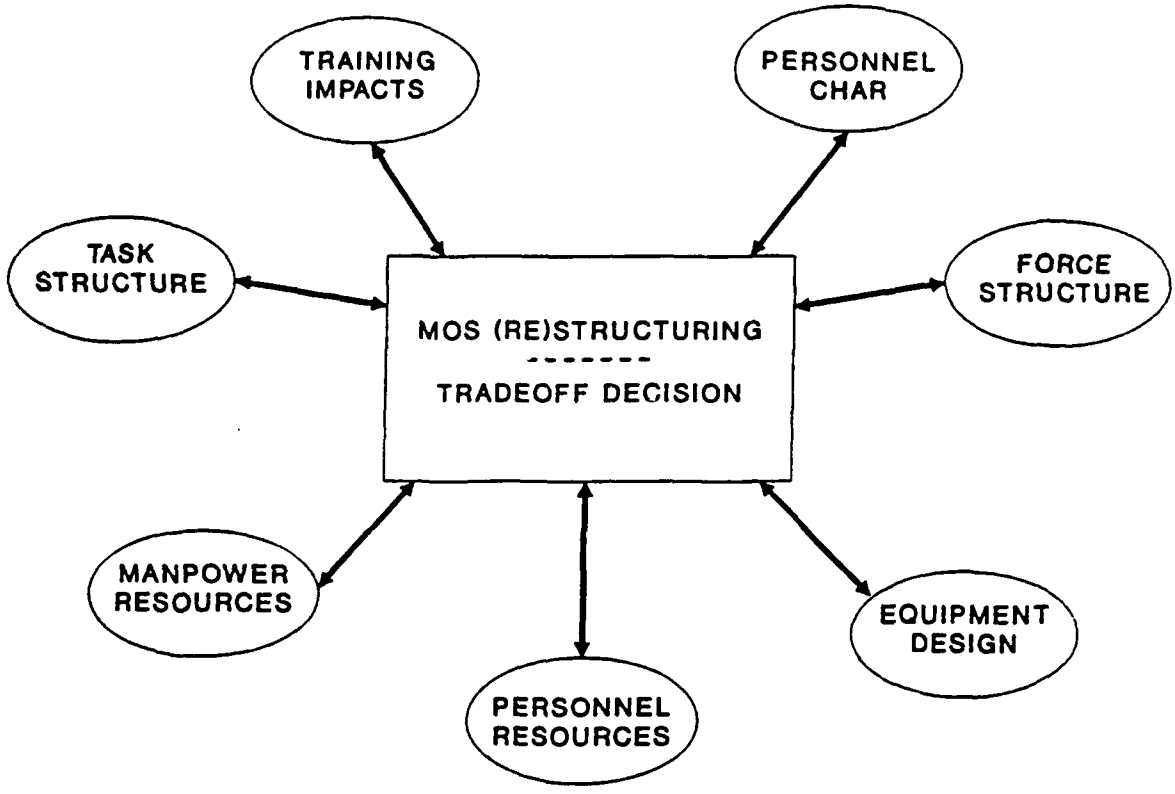

Figure 3. Restructuring tradeoff decision module.

Personnel resources. In addition to personnel characteristics, the proponent also must consider other personnel resource issues. Among these are (1) recruitment and retention of soldiers, (2) increases in training demand and manpower authorizations which place a greater burden on the personnel system, (3) comparison of the tasks required to support the new equipment system with tasks of existing MOSs, and (4) development of an MOS grade structure that will support recruitment, classification, training, assignment, and management of the personnel needed to operate, maintain, and support the new system.

Manpower resources. Effective manpower planning must begin during the initial stages of the preconcept planning process. During this process manpower requirements goals, objectives, and constraints are developed as an integral segment of the new equipment system design. Included in the goals, objectives, and constraints are (1) development and analysis of operator and maintainer tasks, (2) estimates of operations, maintenance, and support equipment requirements, and (3) evaluation of the number and skill level of the personnel required to perform each task. Based upon this information, the proponent develops workload estimates and translates the estimates into the total number of personnel required to support the system. If the workload requirements exceed Army constraints, the proponent must decide if tradeoffs can be made in terms of system design or manpower requirements in order to meet the constraint.

Task structure. This tradeoff and decision factor is concerned with the examination of the adequacy of skills and qualifications required of the operators, maintainers, and supporters to perform mission and equipment system tasks. Once adequacy is established, the tasks must be structured into appropriate experience and skill levels to ensure the most efficient use of equipment system and human capabilities in mission performance. The equipment system proponent should ensure that the task structure and skill level requirements for the new system do not exceed those of currently authorized MOS selected to support the system. If task structure and skill level disparities do exist, the proponent must find tradeoffs in order to minimize or eliminate the disparity.

During any given requirements-based analysis process, the emphasis and order in which these factors are considered may differ. There is uniqueness within each system acquisition process. Therefore, during some acquisition processes, additional factors may require consideration while in others, a few of the listed factors may not require any consideration.

MANPRINT Analytical Methodologies and Products

Although several MANPRINT methodologies and products exist for use in determining the MPT impacts of new equipment system acquisitions, the equipment proponents within the Training and Doctrine Command (TRADOC) have four primary tools or products that are used in determining the MPT impacts of new equipment systems. They are:

1. Hardware versus Manpower (HARDMAN) Comparability Analysis Methodology
2. Early Comparability Analysis
3. Target Audience Descriptions (TAD)
4. FOOTPRINT.

HARDMAN. The HARDMAN Comparability Analysis Methodology (HCM) is a structured approach to determining MPT requirements of a new or improved equipment system. Although the methodology can be applied throughout the system acquisition process, HCM is most effective during the early stages of the equipment system design. HCM is a six step process which includes the following:

1. System analysis
2. Manpower requirements determination
3. Training resource determination
4. Personnel resource determination
5. Impact analysis
6. Tradeoff analysis.

System analysis is performed to identify the equipment system's mission and functional requirements. Once all functions are identified, determinations are made as to the allocation of the functions. Generally, three system constructs are identified in response to the functional requirements of the equipment system concept. The constructs usually include the predecessor system (if one exists), the baseline comparison system (BCS), and the proposed system.

The second step is to determine the manpower requirements. To accomplish this, system descriptions of the operator and maintainer tasks are developed. The tasks include estimates of the time, equipment, and the number and skill of the personnel to perform each task. The estimates are then translated into the total number of personnel required to support the equipment item.

Next is determining training resource requirements. The system proponent develops training person-day requirements for operators, maintainers, and support personnel during this step. Also, the proponent must consider and provide projected instructor requirements, lists of possible training devices, course cost, and expected modifications to current training courses.

Fourth is determining personnel resource requirements. The purpose of this analysis is to determine the total demand on personnel created by the new system. This analysis consists of identifying the personnel in the current inventory required to operate and maintain the system as well as identification of the personnel resources that must be developed to keep the identified operator and maintainer positions filled. The latter category of personnel is developed through constructing career paths which describe recruitment and retention rates, recruit aptitude requirements, training paths, advancement probabilities, as well as other factors impacting the personnel system's capability to support a new equipment system.

Fifth is conducting impact analysis. This analysis assesses the MPT requirements generated by the equipment system against the anticipated supply of resources. Any aspects of the new system concept that places a major demand on MPT resources are identified and possible solutions to MPT issues are identified for further analysis.

The last step in the HARDMAN methodology is tradeoff analysis. This step involves repeating the HARDMAN analysis in order to assess the likely impacts of solutions proposed to correct the problems identified during impact analysis.

Early Comparability Analysis (ECA). ECA is a TRADOC MANPRINT tool designed to assist in the early identification of manpower, personnel, and training "high driver" tasks that can be limited or eliminated in the design of new or improved equipment systems. ECA is used when a predecessor system that will support the determination of MPT requirements can be identified. ECA assumes that most equipment development is evolutionary rather than revolutionary and, therefore, the new system will have essentially the same type of components and perform the same functions.

ECA components consist of (1) identification of relevant operator, maintainer, and supporter MOS of the predecessor system, (2) collection and development of complete tasks lists for each MOS and component of the predecessor system to be studied, (3) collection of tasks data criteria based upon values such as the present number of personnel performing tasks, learning difficulty, performance difficulty, frequency rate,

decay rate, and time required to train the tasks, (4) calculation of ECA task scores to determine "high driver" tasks, (5) performance of task analysis to divide each "high driver" task into individual steps, (6) performance of learning analysis to identify knowledge, skills, and abilities required of a soldier to perform "high driver" tasks, (7) identification of deficiencies by comparing MOS knowledge, skills, and abilities with those required by the new equipment system, (8) determination of solutions based on the deficiencies identified in previous analysis, and (9) documentation of findings once all analysis steps are complete.

Target audience description. A target audience description is a MANPRINT product developed by the equipment proponent to provide information regarding who will operate, maintain, and support the new or revised equipment system. The description is designed to describe the range of individual qualifications on all applicable mental, physical, physiological, motivational, and biographical measurements and how these characteristics relate to the individual's ability to accomplish tasks associated with the operation, maintenance, and support of the equipment system.

The contents of a target audience description are largely dependent upon the system performance requirements of the specific equipment system. Based on the contents, industry makes design decisions to meet Army performance requirements. Accordingly, the data provided by the equipment proponent should reflect the full range of soldier characteristics available in the current and projected manpower pool.

FOOTPRINT. FOOTPRINT is an automated MANPRINT tool designed to support the assessment of the projected MPT requirements associated with a new equipment system. FOOTPRINT utilizes existing Headquarters Department of the Army (HQDA) data bases to develop the MPT profile of MOS for use in developing a target audience description. FOOTPRINT provides the equipment proponent with baseline MPT data for a selected MOS. These data could then be used as the bases for determining changes brought about by the acquisition of a new equipment system. FOOTPRINT reports are broken down into three parts:

1. Performance indicators

2. Training profiles

3. Force structure.

The performance indicators portion of the FOOTPRINT report provides Armed Services Vocational Aptitude Battery (ASVAB) score trends which are based on the quantity and percentage of personnel in a specific MOS found within each ASVAB score range. The data are displayed by the number of personnel in each ASVAB

score range over a number of fiscal years. Also provided in this segment of the report are retention rate trends and years of service (maturity) trends of the MOS force.

Training profiles provide MOS course (by skill level trained) information which includes course number, course title, course length, class size, number of classes held, number of graduates, graduate historical data, and retention rates. Training profiles also contain the basic qualifications in terms of physical demand rating, physical profile required, color vision required, education required, and security clearance needed for award of an MOS along with the skills and knowledge trained at all skill levels.

Force structure information provided by FOOTPRINT includes (1) MOS force structure by grade and total for both required and authorized MOS positions, (2) MOS force structure by additional skill identifier (ASI) broken out by ASI, grade, and total, (3) gender trends broken out by male and female operating strength over seven previous fiscal years, and (4) structure profiles for space imbalanced MOS (SIMOS) implications.

Evolving MANPRINT products. Currently under ARI development, HARDMAN III is a set of six interrelated, microcomputer tools. These tools are designed to assist the equipment proponent in developing systematic descriptions of performance requirements, manpower constraints, personnel constraints, training constraints, and manpower and personnel characteristics requirements at the equipment system level. The System Performance and Reliability and Maintainability (RAM) Criteria Aid (SPARC) is being designed to develop system performance requirements based on 21 different simulation models representing major classes of Army equipment systems.

The Manpower Constraints Aid (M-CON) provides crew size constraints so that designers develop equipment with manning requirements not exceeding the constraints. The model is based on predicting MOS availability. Requirements are projected against the expected MOS population until there is consistency between new and existing demands as well as supply.

The Personnel Constraints Aid (P-CON) provides soldier performance characteristics which can be integrated with other design dimensions. The model deals with soldier characteristics that are MOS sensitive and those that are not. The system predicts ASVAB and mental category (CAT) distributions for each MOS; these are mapped to a series of equations based on the ARI Project A data base. P-CON produces soldier characteristics information on age, language, ability, sex, size, strength and perceptual abilities for the MOS group.

The Training Constraints Aid (T-CON) describes probable training so that design requirements will not require skill levels that cannot be achieved by available training. The system provides training hours for operations and maintenance. For operations, T-CON provides training hours per operations function, MOS and course, the general type of training per function, and training difficulty. Maintenance training data include training hours per subsystem, per course, and MOS, the general type of training, and the training difficulty.

These four models are designed to provide the equipment designer with constraints that translate into equipment performance levels. Equipment is designed to achieve certain performance requirements. HARDMAN constraints indicate the capabilities achievable based on the projected availability of MPT resources. The final two models included in HARDMAN III are designed to be used in evaluating system designs.

The Manpower-Based System Evaluation Aid (MAN-SEVAL) is being developed to evaluate designs by determining the jobs and number of personnel per job required to operate and maintain the hardware and software. The Army will then have the basis to determine manpower requirements in comparison to manpower availability.

The sixth product, the Personnel-Based Evaluation Aid (PER-SEVAL), evaluates designs by determining the human characteristics and required level of each necessary to operate and maintain a given design to performance criteria. If the average soldier is unable to operate or maintain the system to criterion levels, ASVAB, physical profile demands, and Military Enlistment Physical Strength Capacity Test (MEPSCAT) scores are raised and the model rerun until system performance is achieved.

The relevance of the HARDMAN III products to this research effort on requirements-based MOS restructuring may be significant. MPT and equipment design evaluation data provided by HARDMAN III may be pertinent in terms of a baseline for the design of requirements-based restructuring methods. However, since none of the HARDMAN III products are operational, the utility of using data from these products as a baseline for developing requirements-based restructuring methods cannot presently be determined.

Summary

In sum, the policy and procedural baseline from which to weigh improvements to requirements-based MOS restructuring is characterized by the formal MANPRINT procedures performed throughout the phases of the system acquisition process. The development of MOS assessment methodologies which can be used in the earliest phases of system acquisition would provide the

greatest opportunity to formulate requirements-based MOS restructuring needs in parallel with major decisions on system design and resource constraints. Early identification of MOS restructuring needs is paramount to fielding fully trained and qualified soldiers concurrent with the fielding of the new equipment system.

Requirements-Based MOS Restructuring

Requirements-based MOS restructuring occurs as part of the equipment system development process when existing MOS cannot satisfy the requirements stemming from new equipment. When this mismatch occurs, questions must be raised and answered regarding the revision of existing MOS or creation of new MOS to meet the demands.

The Army does not have a formal, documented process by which requirements-based MOS restructuring occurs. Nonetheless, restructuring decisions are made and generally are based on an analytical process. Improvements to that process are both desireable and feasible; however, an explicit baseline must be defined.

The purpose of this section is to explicitly describe the requirements-based MOS restructuring process. First, the steps by which this type of restructuring occurs are identified and described; this description is presented in the context of MANPRINT and its related MPT planning processes. Second, the key school house participants are identified and their roles described; these include the combat developer, the training developer, and the personnel proponent. Finally, some recent examples of requirements-based restructuring are discussed.

The Requirements-Based Analytical Process

The process for MOS restructuring during the equipment development process is an inherent part of MANPRINT yet not explicitly defined. In the myriad of MPT analyses that are triggered by MANPRINT, many actions have bearing either directly or indirectly on MOS structuring. At a minimum, one issue the MANPRINT analyst must resolve is the selection of MOS to operate, maintain, and otherwise support the new equipment. Often the issue is resolved by the selection of an existing MOS and the development of some additional training. When these actions are not sufficient, however, requirements for a new MOS or a restructured MOS arise. Then, analyses must be performed to determine how to modify existing MOS or create new ones to meet the requirement.

Figure 4 portrays features of the MANPRINT program that ultimately bear on MOS restructuring. The point of departure for MANPRINT is the development of a new piece of equipment. Prior to Milestone I, the reference is usually to a BCS or notional system around which analyses can be performed in the absence of the actual hardware and software. Subsequently, the analytical focus is the initial prototypes or developmental models which are tested through developmental test and evaluation (DT&E) or operational test and evaluation (OT&E).

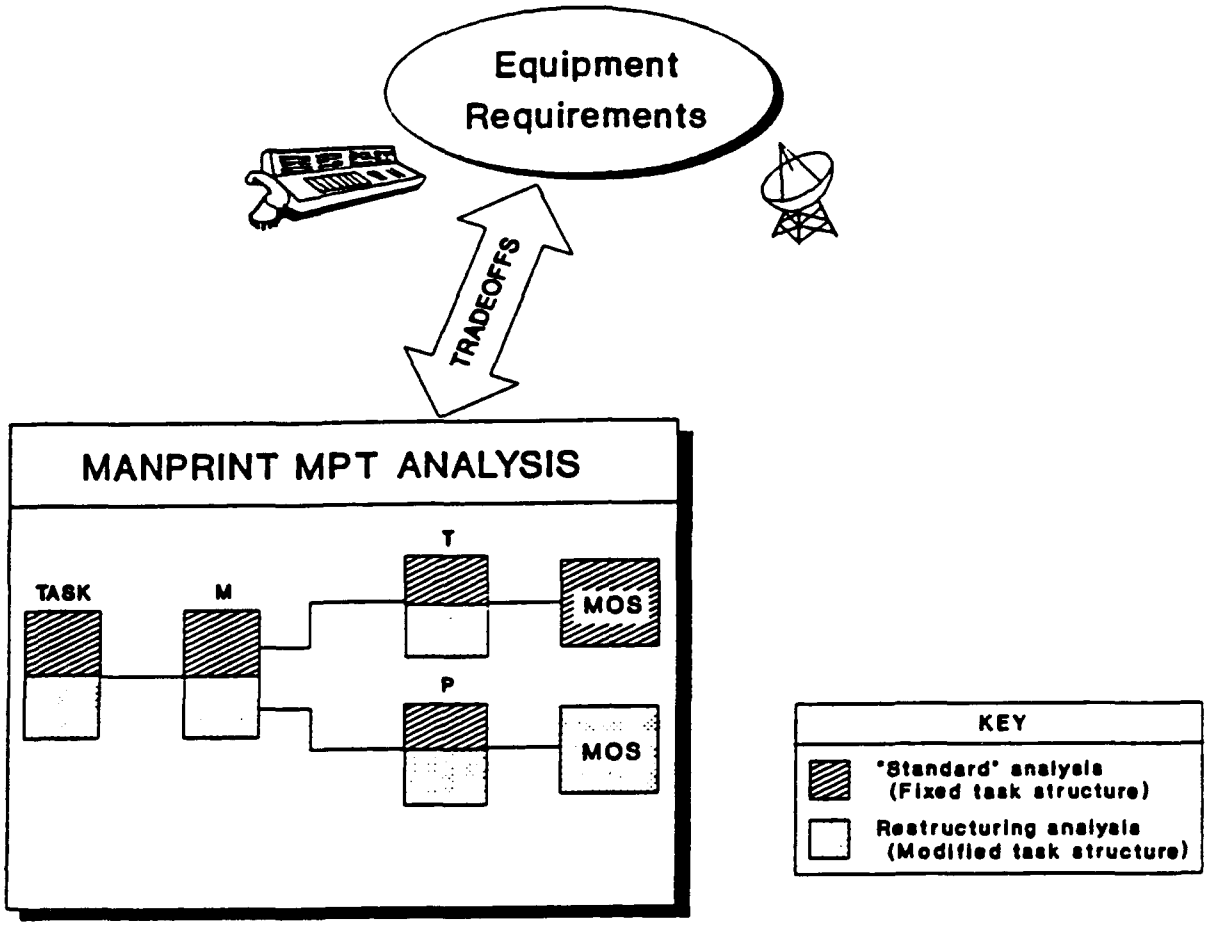

Figure 4. Manpower, personnel, and training (MPT) analytical process and MOS restructuring.

Analytically, a task analysis based on the new equipment is performed. The task analysis identifies critical tasks and associated characteristics such as workload, required abilities and skills, and personnel characteristics, among others. These data are used to project manpower requirements in terms of aggregate numbers of operators, maintainers, and support manpower. The task and manpower analyses lead to training assessments and personnel requirements analyses. At some point, there is a set of MPT requirements associated with the new equipment. This set of requirements is supposed to be reconciled with equipment characteristics as well as the other MANPRINT domains through a tradeoff analysis to arrive at an optimal mix of MPT resources and equipment design features.

This process theoretically should occur iteratively throughout the equipment system acquisition process as the equipment design changes and is refined. Resources for performing this analysis may limit the extent to which these iterations in fact do occur.

As long as the result of the MANPRINT process from the MOS perspective leads to selection of existing MOS which require little or no modification, restructuring is not an issue. However, there are times when MPT issues and equipment design cannot be resolved within the constraints posed by existing MOS structures. When this happens, the MANPRINT analytical process leading from equipment design to task analysis to MPT requirements assessment and tradeoff analyses takes on a different cast, namely it becomes a requirements-based MOS restructuring process.

The analytical steps required to address requirements-based MOS restructuring are at least functionally the same MANPRINT steps that should occur when existing MOS are selected. The scope of the analysis is broader inasmuch as the convenience of working with well defined occupational structures no longer exists. Instead, the analyst must use the results of his task analysis to revise existing MOS structures or to structure new occupations. Furthermore, analysis must be extended from the single new system and MOS to integrate these new or revised occupations into the Army's force structure and revised equipment inventory. There becomes a need to assess the equipment-job match at the soldier and equipment or micro levels as well as to evaluate this solution against the force structure and equipment inventory, or macro levels.

Figure 5 portrays the MOS restructuring process in the context of the equipment system acquisition process. Assuming that the MANPRINT analysis is occurring in a restructuring mode, the combat developer in conjunction with the MJWG has lead

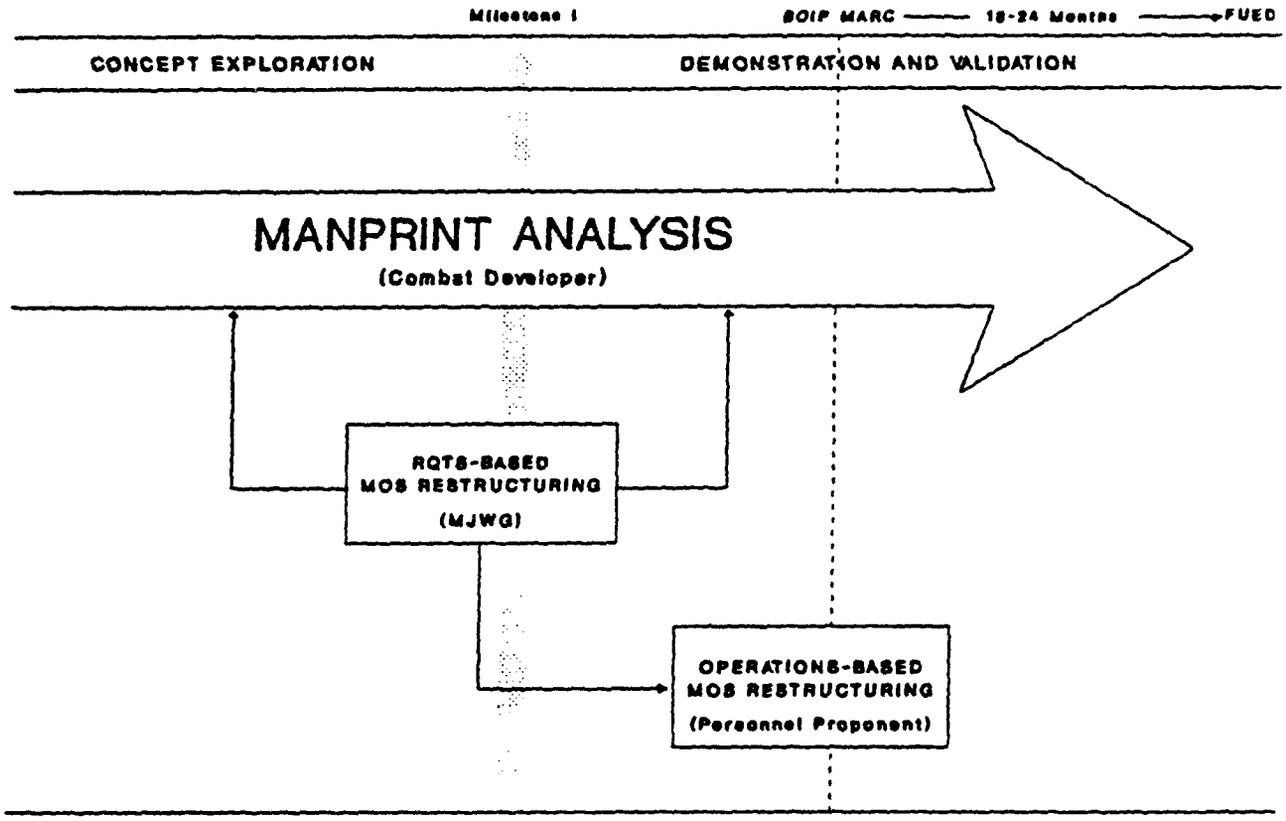

Figure 5. MANPRINT and MOS restructuring during the materiel acquisition process.

responsibility for addressing MOS restructuring throughout the acquisition process. As changes in equipment concept or design occur, the MANPRINT analysis must be repeated so that the MPT issues are refined and resolved simultaneously with the evolution of the equipment. Requirements-based MOS structuring analysis, therefore, occurs repeatedly until the BOIP manpower requirements criteria (MARC) is developed, usually after Milestone I. When this occurs, the MOS structuring strategies and job performance requirements which have evolved through the requirements-based process now become guidelines and parameters for use by the personnel proponent in performing operations-based MOS structuring studies. Optimally, this shift from requirements-based to operations-based analysis should occur 18-24 months before the first unit equipped date (FUED) so that changes in the MOS structure can be implemented.

There is no formal, documented requirements-based MOS restructuring analysis process. However, when requirements-based analysis does occur, there are a number of analytical steps that should be performed as illustrated in Figure 6:

1. MOS restructure assessment
2. Equipment-MOS task review
3. Task aggregation
4. MOS Manpower analysis
5. MOS training analysis
6. MOS personnel analysis
7. Requirements-based tradeoff analysis
8. MOS impact analysis
9. MOS guidance.

MOS restructure assessment. The purpose of the first step is to determine whether MOS restructuring analysis is required. This question must be addressed each time an MPT analysis occurs during the equipment system acquisition process. If restructuring analysis is required, the subsequent analytical steps will be performed. On the other hand, if restructuring analysis is not required, "standard" MANPRINT analysis would be conducted to determine the best MPT resource mix based on existing resources and occupational structures.

Table 2 provides the features of an MOS restructuring assessment in terms of data requirements, performance steps, and resulting products. An MOS restructuring assessment is accomplished by reviewing all available MANPRINT data such as the

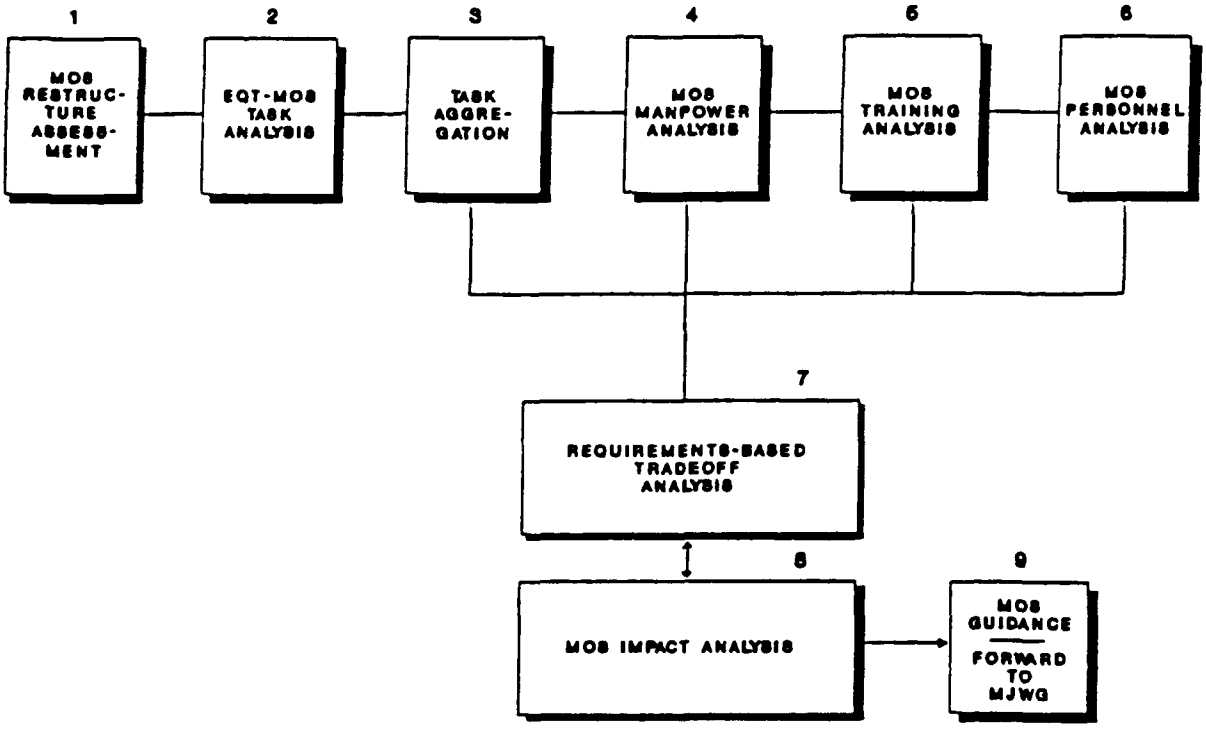

Figure 6. Requirements-based MOS restructuring analysis flowchart.

Table 2

MOS Restructuring Assessment

PURPOSE
Determine Need for MOS Restructuring Analysis
INPUTS
Operational and Organizational (O&O) Plan Baseline Comparison System (BCS) Data Target Audience Description (TAD) Data FOOTPRINT Data
STEPS OF PERFORMANCE
Analyze O&O Plan for Manpower and Force Structure Implications Analyze TAD and FOOTPRINT for MOS Suitability Analyze BCS for MOS Implications Determine if Restructuring Conditions Exist
OUTPUTS
Decision as to Whether to proceed with MOS Restructuring Analysis

O&O plan, BCS data, TAD, and FOOTPRINT data to determine the general manpower and force structure implications of the new equipment system. Once these are determined, an assessment is made to decide if restructuring analysis is required. As a rule, MOS restructuring analysis is required if any of the following conditions exist:

1. The new equipment system has unique task requirements for which no existing MOS can be identified;

2. The new equipment tasks cannot be supported without restructuring the tasks of an existing MOS;

3. Assigning the equipment tasks to an existing MOS would be against current policy.

4. The new equipment task demands cannot be met without revising the skill level demands of an existing MOS;

5. The new equipment task demands will increase the manpower requirements of an existing MOS to the point where the MOS's current grade structure will no longer be valid.

If the conclusion is that a new or revised MOS may be required to support the demands of the new equipment system, then the subsequent requirements-based steps are performed prior to making a final restructuring decision.

Equipment-MOS task review. Once the decision has been made that a restructuring analysis is required, an equipment-MOS task review is performed to establish the bases for job performance. As outlined in Table 3, the purpose of this task review is to assess mission and operational concepts for the new equipment as a basis for then enumerating task requirements in terms of activities, frequencies, and other job characteristics.

Much of this analysis work is accomplished as part of ECA. If the ECA task analysis is complete, the analyst would proceed to the next step. However, the object here is to ensure development of occupational requirements based solely on the demands of the equipment system. This analysis does not take into consideration any of the other elements of ECA.

Alternative task aggregations. The purpose of the third step is to combine new equipment tasks into occupations. Basically, questions such as: What set of tasks constitutes an MOS? Can new tasks be attached to an existing MOS? Can task structures of existing MOSs be modified to meet the requirements? Will the tasks demands of the equipment system require development of a new MOS?

Table 3

Equipment-MOS Task Review

PURPOSE
Establish the Basis for MOS Job Performance
INPUTS
ECA Data (if available) O&O Plan BCS Data System Development Contractor Task Analysis (if available)
STEPS OF PERFORMANCE
Review ECA for Completeness and Accuracy of Equipment Tasks If ECA Data are not Available: - Analyze O&O Plan for Overall Mission Tasks - Analyze BCS Data and Develop Equipment Tasks Analyze System Contractor Tasks List
OUTPUTS
New System Tasks Requirements List

Table 4 lists the required data, procedural steps, and outputs from this analysis. The inputs to this step are the new system task requirements list derived from the preceding step. During the task aggregation process, several analytical procedures must be accomplished in order to answer the MOS task structuring questions as outlined above.

First, a comparative analysis between the equipment tasks and MOSs listed in the TAD or FOOTPRINT is performed to ascertain which MOSs are most capable of performing the required equipment tasks. The MOSs (if any) that provide the greatest capability to support the new equipment system are selected for further development.

Next, a task deficits list is developed and analyzed to determine if any of the tasks can be incorporated with the existing MOS tasks with minimal changes in the MOS's tasks structure. This process is aimed at further defining the selected MOS's capability to support the new equipment system and minimizing the impact of the new equipment system on MOS training and force structure.

Finally, the equipment task requirements that could not be supported by the current MOS are aggregated with the current MOS's tasks. The combined tasks are then analyzed and structured to meet the equipment demands. This structuring process provides an indication of how the MOS should be structured in terms of grade and skill level requirements. If no MOS could be selected to support the new equipment tasks, then the equipment task requirements are aggregated into notional skill levels and become the basis for the development of a new MOS.

The output from the task aggregation process provides a revised task list for a current MOS or a list of tasks for an MOS that must be developed. The lists constitute the baseline for restructure of the existing MOS or the development of new ones.

MOS manpower analysis. The purpose of the fourth step is to determine the total number of MOS positions needed to support the equipment system. Table 5 provides the required data, procedural steps, and results of the analysis process. This step should not be confused with the development of the formal MARC for inclusion in AR 570-2. This analysis process is performed to develop analytically-based estimates of the time required, skill level needed, and grade structure required of personnel to perform each task on the list provided by the previous analytical step.

Once the analysis is accomplished, estimates of MOS productive time, grade and skill levels, and total number of MOS

Table 4

Alternative Task Aggregations

PURPOSE
Aggregate New System Task Requirements into Occupations
INPUTS
New System Task Requirements List TAD Data FOOTPRINT Data
STEPS OF PERFORMANCE
Perform Comparative Analysis between Equipment Task Requirements List and MOS TAD or FOOTPRINT Data Develop Task Deficits List Aggregate MOS Tasks Structure MOS Tasks
OUTPUTS
Revised MOS Task List New MOS Task List

Table 5

MOS Manpower Analysis

PURPOSE
Determine the Number of MOS Requirements Needed to Support the Equipment System
INPUTS
MOS Task List Estimated Number of Systems to be Supported
STEPS OF PERFORMANCE
Develop Analytically Based Estimates of the Time and Skill Level of Personnel Required to Perform Each Task (Use Subject Matter Experts)
OUTPUTS
Estimated MOS Productive Time Estimated MOS Grade and Skill Levels Estimated Total Number of MOS Manpower Requirements

manpower requirements can be developed to determine the overall manpower support required by the equipment system. After the requirements are determined, current manpower constraints are then overlaid and unresolved manpower resource issues documented.

MOS training analysis. The purpose of MOS training analysis is to determine the training resource requirements generated by the new equipment system and subsequent MOS task restructuring. As depicted in Table 6, training analysis requires that a great deal of information be analyzed in support of determining training resource requirements.

MOS training analysis in terms of requirements-based MOS restructuring is performed to acquire an overview of training resource requirements and to generate an initial plan for developing training to support the new equipment system. The process provides for the analysis of equipment tasks, MOS tasks, and manpower requirements, as well as doctrinal and organizational requirements to determine the critical tasks to be performed by the MOS.

Once the critical tasks are established, an initial plan for training soldiers to perform these tasks is developed. The initial training plan includes estimates of the length of training, number of instructors required, number of classes per year, number of students per year, and projected increases or decreases in the trainees, transients, holdees, and students (TTHS) account. Upon completion of these analytical and development processes, training constraints are overlaid and unresolved training resource issues documented.

MOS personnel analysis. Table 7 summarizes the process for MOS personnel analysis. The purpose for this analysis step is to determine if the MOS manpower and training demands created by the aggregation of tasks to support the new equipment system are also supportable from a personnel aspect.

During this analysis phase, MOS manpower and training requirements are analyzed to judge their implications on personnel resource requirements. Among the information to be developed during this process are (1) estimates of accession requirements, (2) definition of career paths, (3) development of training paths (advanced individual training, primary leadership training, basic noncommissioned officers training etc.), (4) determination of grade distribution and advancement probabilities, and (5) determination of MOS retention requirements. Once this information is established, personnel constraints are overlaid and unresolved personnel resource issues are documented.

Requirements-based tradeoff analysis. Throughout the time when the equipment-MOS level analyses are occurring, tradeoffs between

Table 6

MOS Training Analysis

PURPOSE
Determine MOS Training Resource Requirements
INPUTS
Equipment Task Requirements List New or Revised MOS Task List MOS Manpower Requirements Doctrinal Requirements Organizational Requirements Training Constraints FOOTPRINT Data
STEPS OF PERFORMANCE
Analyze All Data Inputs and Develop Critical Task List Analyze Critical Tasks Develop Initial Collective and Individual Training Plan Analyze FOOTPRINT for Current Training Data
OUTPUTS
MOS Critical Task List Initial Collective and Individual Training Plan

Table 7

MOS Personnel Analysis

PURPOSE
Determine the Personnel Supportability of New Equipment, Manpower, and Training Demands
INPUTS
Estimated MOS Manpower Requirements Estimated MOS Training Requirements Personnel Constraints
STEPS OF PERFORMANCE
Analyze MOS Manpower and Training Requirements and Estimate the Total Personnel Resource Demand
OUTPUTS
Estimated MOS Personnel Resource Requirements Accession Rates Career Paths Training Paths Retention Rates Advancement Rates Personnel Distribution

equipment-driven task requirements and MPT requirements must be considered. Tradeoff assessments will not necessarily occur in any sequence or only one time. As the MOS solutions evolve, the tradeoffs between equipment and MPT resources must repeatedly be examined. Therefore, tradeoff analysis as currently performed can best be described as a systematic reiteration of the restructuring analytical steps. The purpose of this step is to determine if solutions proposed to correct the issues defined in earlier analysis steps will in fact resolve the issues.

MOS impact analysis. The analyses occurring in the preceding seven steps generally focus on the relationship between the equipment and the soldier. This micro view is critically important. However, if the restructuring solution was arrived at in this setting alone, there is substantial risk that the answers will be suboptimal and that other important MPT or equipment programs could be seriously negatively affected. Therefore, the equipment-MOS solutions developed in the preceding steps must also be elevated into a broader set of assessments encompassed in MOS impact analysis. The same statements may also be true of MOS restructuring actions stemming from changes in, for example, doctrine, mission, or force structure.

The purpose of the MOS impact analysis is to perform macro level assessments evaluating the effect of integrating a new or modified MOS structure into the Army. Table 8 provides the process for this analytical step. During MOS impact analysis, estimated MOS MPT resources are evaluated against current MOS, CMF, and Army MPT resource requirements. The main thrust of the analysis is to answer these questions within the scenario of current or projected Army constraints:

1. How will the manpower requirements needed to support the new equipment system impact on the capability to provide the resources needed for existing MOS, CMF, or Army manpower requirements?

2. How will the training requirements needed to support the new equipment system impact on the capability to provide the resources for existing MOS, CMF, or Army training requirements?

3. How will the personnel requirements needed to support the new equipment system impact on the capability to provide the resources for existing MOS, CMF, or Army personnel requirements?

The questions may seem obvious or even simplistic. However, unless these questions are analyzed and macro MPT issues developed and documented, the risk of creating more equipment-MOS problems than are solved is very real.

Table 8

MOS Impact Analysis

PURPOSE
Evaluate the Effect of Integrating a New or Modified MOS Structure into the Army Force Structure
INPUTS
Initial MOS Manpower Resource Estimates Initial MOS Training Resource Estimates Initial MOS Personnel Resource Estimates Current MOS Manpower Resources Current MOS Training Resources Current MOS Personnel Resources
STEPS OF PERFORMANCE
Analyze Current and Estimated Manpower, Personnel, and Training Resources Determine and Document the Impacts that System Driven Revisions in MOS Manpower, Personnel, and Training Will Have on Existing MOS, CMF, and Army Force Structures
OUTPUTS
Macro Level MOS Structuring Issues

MOS guidance. The final step in the process is to document and forward the results to the MJWG for review and follow-up action. During early stages of the acquisition process, these MOS strategies will be used as inputs to successive iterations as the equipment design solidifies and prototypes are developed. Later, when the Army prepares to field the equipment, the results of the requirements-based MOS analysis will serve as guidance to the personnel proponent responsible for initiating operations-based MOS analysis and preparing the MOS action for DA approval.

The preceding description identifies the principal steps that should occur in a requirements-based MOS restructuring analysis. Whether this happens as systematically and rationally as portrayed here is unlikely. Limited time and resources often interfere with MANPRINT performance. Nonetheless, when MOS restructuring is addressed during equipment system acquisition, implicitly at least many of the steps and analyses identified here must occur. In any event, the description here provides a baseline which can be used to identify opportunities to improve the current process as well as to develop a fuller, broader description of both the requirements-based and operations-based MOS restructuring process.

Responsible Agencies

Requirements-based restructuring is largely an ad-hoc group process administered by the training center's combat developer. Other members of the group include, as a minimum, the training developer and the personnel proponent. This group can best be described as a subset of the MJWG. Although this group shares significant responsibility in the management of the MANPRINT process, they are treated as a separate team in this document to avoid confusion.

Figure 7 depicts the interrelationships required of the group in order to ensure that restructuring actions resulting from equipment system acquisitions are accomplished in sufficient time to support equipment fielding. The combat developer, training developer, and the personnel proponent all provide distinct MPT input to the MANPRINT program. Because of this, they are also bound together through the process of requirements-based MOS restructuring. A single independent decision in the implementation of a restructuring decision by one participant will often affect or compromise the integrity of the other participants' programs. Therefore, participation of all three disciplines in the requirements-based restructuring process is imperative.

The combat developer has lead responsibility in the requirements-based restructuring process. The combat developer is responsible for ensuring all equipment system driven

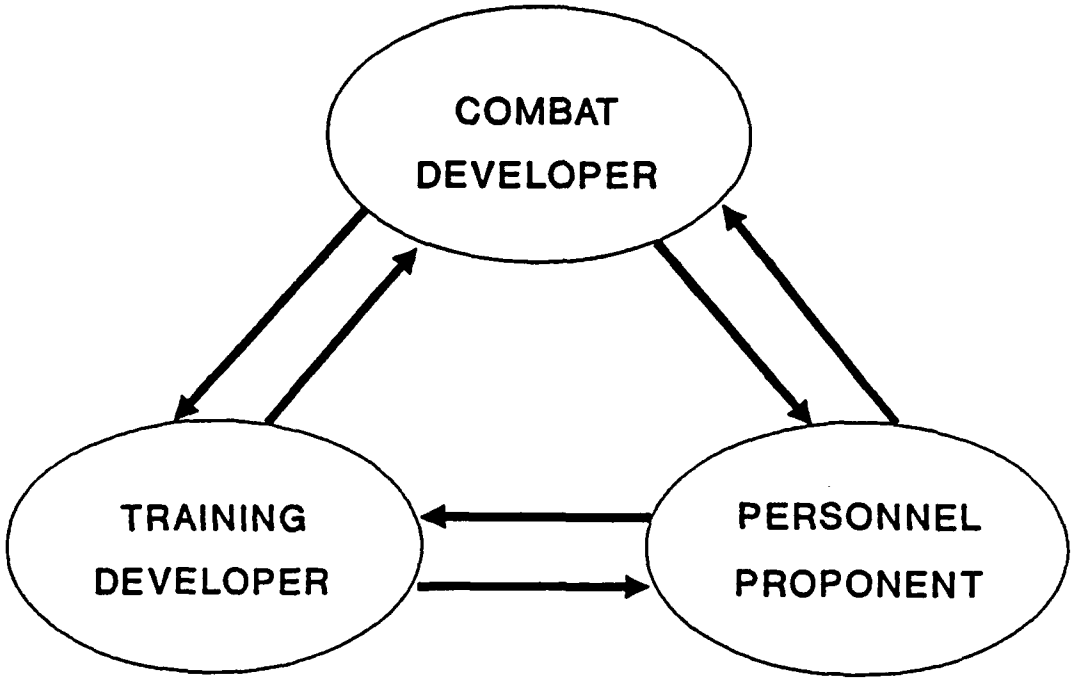

Figure 7. Restructuring team interrelationship.

restructuring requirements are identified and documented. To this end, the combat developer along with the training developer and personnel proponent (1) determines equipment system tasks requirements, (2) selects operator and maintainer MOSs, (3) determines manpower requirements, (4) determines adequacy of the MOSs to support the requirements, and (5) determines the need for MOS restructuring.

The training developer has responsibility for identifying the training impacts of requirements-based MOS restructuring. In support of the restructuring effort, the training developer (1) analyzes training requirements and develops training strategies, (2) determines training constraints, (3) develops and analyzes critical training tasks, (4) determines aptitude and skill needs, (5) develops collective and individual training plans for the new or revised MOSs, and (6) provides training issues input to the combat developer to support restructuring decisions.

The role of the personnel proponent in requirements-based MOS restructuring is usually advisory in nature. The personnel proponent makes recommendations to the combat developer on issues such as (1) personnel constraints, (2) grade structure requirements, (3) personnel accession strategies, (4) distribution of personnel quality, as well other personnel life cycle management issues. Once the requirements-based MOS restructuring decisions are made, the personnel proponent performs operations-based restructuring analysis and develops the required MOS restructuring action submittals for DA approval.

Examples of Requirements-Based MOS Restructuring

Requirements-based restructuring has frequently occurred as a result of new system acquisitions as well as changes in doctrine and organizational structures. Examples exist from all branches of the Army. The following are two examples of requirements-based restructuring efforts. The first is an example of restructuring which is driven primarily by equipment acquisition. The second is an example of MOS restructuring driven primarily by doctrinal and organizational changes.

A prime example of requirements-based MOS restructuring was the Department of Defense (DOD) directed development and implementation of Deployable Medical Systems (DEPMEDS). DEPMEDS involved the procurement of state-of-the-art medical equipment and integrating the equipment into field medical units of the Army, Navy, and Air Force.

DEPMEDS presented some very difficult issues for the Army Medical Department to overcome. First, maintenance doctrine required revision in order to incorporate the overall changes in equipment technology and provide support for the introduction of high technology, low density medical equipment (fiber optics,

tomography, high capacity X-ray, etc.) to forward deployed field hospital units.

Next, an assessment of training revealed that medical equipment repair training could not support evolving medical maintenance doctrine nor the maintenance tasks demands of DEPMEDS equipment. Additionally, MOS tasks structures for both MOS 35G, Biomedical Equipment Specialist (Basic), and MOS 35U, Biomedical Equipment Specialist (Advanced), required major revision and new tasks added, therefore increasing training for both MOSs. In addition to training increases, the technological advances presented by DEPMEDS equipment also required personnel quality for both MOSs to be increased.

Finally, as a result of equipment demands, doctrinal changes, and training revisions, both MOS 35G and MOS 35U required major restructuring and development of a totally revised personnel support system. The restructuring effort included (1) increasing the task and skill requirements for both MOS 35G and MOS 35U, (2) designation of MOS 35G as the primary organizational maintainer in division level organizations rather that MOS 35U, (3) increasing E3, E4, and E5 requirements in MOS 35G and decreasing E5 and E6 requirements for MOS 35U. The reductions in 35U E5 and E6 requirements provided a tradeoff for the increases in training for both MOSs.

Revisions in the personnel support system included restatement of accession requirements, increases in the TTHS account, reclassification of personnel in MOS 35U, restructuring in terms of grade and skill requirements for both MOSs, and improvement of career progression potential for MOS incumbents.

Another good example of requirements-based restructuring is now beginning to evolve at the U.S. Army Ordnance Center and School. The Army's Ordnance Branch has recently developed a plan to make major revisions in maintenance doctrine, organizations, and equipment in order to support the Army's overall Airland Battle-Future (ALB-F) Plan. These revisions are incorporated in the Battlefield Maintenance System (BMS) which is now being formulated and is projected for implementation in 1995. The BMS concept, if approved, will:

1. Revise the current maintenance system
2. Revise maintenance responsibility
3. Change the repair parts system
4. Implement a fix forward doctrine
5. Realign and merge maintenance MOSs

6. Increase operator and crew maintenance tasks requirements

7. Revise the organizational structure of maintenance units.

BMS will employ a four level maintenance system rather than the current five levels of maintenance. Todays levels of maintenance consist of unit, organizational, direct support, general support, and depot maintenance. Under BMS, the operator and crew will have responsibility for what was unit maintenance and what was formerly organizational and direct support maintenance will be combined and redesignated as field maintenance. Proponents of BMS feel that by combining the functions of organizational and direct support maintenance, numerous efficiencies in terms of repair times, equipment, and personnel requirements can be realized.

As a product of the revision in maintenance levels, the responsibility for all maintenance of equipment (other than operator and crew) will be assigned directly to maintenance units. In addition, all maintenance personnel will also be assigned to maintenance units. This is a departure from the current system of assigning maintenance personnel to combat units for the provision of unit and organizational maintenance support. Therefore, all maintenance beyond operator and crew will be the responsibility of a maintenance unit that will be assigned in "habitual support" to the combat unit.

The repair parts system will change significantly from the current system. Under BMS, the use of rapid ground and air resupply for low density, critical, and high value items will increase operational capabilities and reduce the need for large stocks of repair parts in forward maneuver elements. The repair items stocked in the forward areas will be limited to battle damage repair (BDR) items, combat stocks (CS), and line replaceable units (LRU) or component parts. No repair parts that are not mission essential will be stocked in forward units.

BMS will implement the "fix forward" doctrine which is a critical component of ALB-F. Implementation of the fix forward doctrine will require some equipment modernization. One equipment modernization need is a rapid recovery vehicle (RRV) capable of quickly removing an inoperable vehicle to a relatively safe location for repairs. Another equipment demand of the "fix forward" doctrine is an armored maintenance vehicle (AMV) capable of maintenance lift, light vehicle recovery, and the capability of transporting and storing repair parts, tools, technical references and data, and BDR supplies.

The consolidation of organizational and direct support maintenance will generate the need to revise and merge several maintenance MOSs. Just how many maintenance MOSs will require revision and merging is unknown at this time. A study is ongoing at the Ordnance Center in order to make these determinations. However, given the sweeping changes in doctrine and organizational structures proposed in BMS, the effect on the current maintenance MOSs will be profound.

Several of the maintenance tasks currently being performed by maintenance personnel will be transferred to the vehicle operator and crew as "crew tasks". The tasks will be limited to tasks that can be performed by the crew while using on board combat spare parts and tools.

The organizational structure of maintenance units will also change under BMS. Additionally, BMS will have an impact on the organizational structure of almost every division level maneuver unit that currently has maintenance personnel required as the requirements will be removed from those units and placed in maintenance units. The maintenance organization changes proposed in the BMS concept are both complex and too numerous to list in this document. However, these changes will have profound impacts on how maintenance is currently organized, trained, and conducted.

BMS will create an abundance of MPT issues that must be resolved if BMS is to be successful. The issues will extend across almost all functional areas (Armor, Infantry, Artillery, etc.) and require an extensive technical and management effort. BMS also poses some significant requirements-based restructuring issues. Chief among these are:

1. Will BMS require a major MOS restructuring and merger effort?

2. How will consolidation of organizational and direct support maintenance effect the structuring of maintenance MOS tasks and grade structures?

3. Will the new BMS organizations require a change in the mix of MOS requirements?

4. What effects will BMS have on MOS grade distribution, accession and career progression paths, physical demands, and personnel quality requirements?

5. Will BMS require significant changes (restructuring) in MOSs for operators and crew as well as maintainers?

In sum, BMS will potentially require a massive requirements-based restructuring effort to be undertaken by the Ordnance Center. The success of this concept will be dependent on early thorough MPT and restructuring analysis. These analyses must be at the level of detail to support quantitative decision making and tradeoff identification.

Opportunities For Improving Requirements-Based MOS Restructuring

Research reveals that requirements-based MOS restructuring occurs as part of MANPRINT in the equipment system development process when existing MOSs may not satisfy the requirements stemming from new equipment. Although current regulatory guidance, policy guidance, and handbooks provide an abundance of guidance on performing MANPRINT analytical processes, the current methods fall short in providing a solid framework for the analysis and design of MOSs when task restructuring is required due to either the introduction of new systems or other changes (e.g., doctrine, organization, mission).

In practice, the Army does not have a formal, documented process by which requirements-based MOS restructuring occurs. However, the preceding section describes the principal steps that should occur in a requirements based MOS-restructuring analysis and forms a baseline which can be used to improve the current process.

The purpose of this section is to (1) identify deficiencies in the current requirements-based restructuring process which may benefit from research and development and (2) target high impact opportunities for improving requirements-based MOS restructuring.

This section consists of three subsections. First, the findings and conclusions resulting from the research are summarized. Next, requirements-based restructuring practices are evaluated with respect to deficiencies and potential improvements in analytical procedures offering the greatest benefits. Finally, research initiatives are identified to support improvement of requirements-based MOS restructuring.

Research Conclusions

Despite the availability of several MANPRINT methods (Bogner, 1988), very little explicit guidance exists to support requirements-based MOS restructuring. Based on this finding, one need is to develop a procedural guide equivalent to the Military Occupational Classification Structure (MOCS) Handbook. This need will become more evident in subsequent subsections in which potential improvements are discussed.

The absence of explicit guidance and analytical procedures offers other significant opportunities to improve the requirements-based restructuring process. These opportunities can be attributed to:

1. The lack of documented, predefined conditions from which to judge the need to perform requirements-based restructuring analysis;

2. The need for a restructuring checklist that assists in ensuring that all analysis areas are considered, restructuring MPT resource constraints are identified, tradeoff requirements are identified, and findings documented;

3. The lack of systematic tools and methods for performing requirements-based tradeoff analysis; and,

4. The lack of well defined methods to assess the macro-level impact of integrating new or revised MOSs into existing CMF and Army force structures.

Enhancing the Requirements-Based MOS Restructuring Process

There are many ways to improve requirements-based MOS restructuring. The opportunities exceed the resources currently available although there are potentially many payoffs to the Army that may result from investing in these recommended improvements. Table 9 lists five potential improvements which may be initiated within the framework of this research effort.

These initiatives are described here in general terms; conceptual development has not been undertaken nor has feasibility been determined. The ascending order reflects a programmatic priority which may be altered as a function of resources or other considerations. Each is discussed in terms of its purpose and uses in requirements-based MOS restructuring. The focus is on developing methods that will produce quantitative and replicable results, in contrast to methods currently used for early restructuring analysis which are somewhat "best guess" in nature.

System architecture for requirements-based MOS restructuring. The research initiatives representing improvements to individual steps in the requirements-based restructuring process can lead to improved, more effective procedures. However, this opportunity can be lost if each of these improvement initiatives is addressed independently. Independent improvement efforts are effective only by happenstance. To make significant improvements to the requirements-based restructuring process, there is a need for an overall system architecture and strategy as a framework for setting priorities and undertaking development.

The purpose for this initiative is to create a system architecture that identifies all critical analytical, data processing, and data management components of a systematic, quantitative, and replicable analytical support system for requirements-based MOS restructuring.

Table 9

Enhancing the Requirements-Based Restructuring Process

1. System Architecture for Requirements-Based MOS Restructuring
2. MOS Restructuring Assessment Aid
3. Requirements-Based Tradeoff Analysis Method
4. MOS Impact Analysis Method
5. Requirements-Based MOS Restructuring Handbook
6. MOS Action Plan Generator

The architecture may be used to identify priorities as well as formulate development strategies. This effort would produce a master plan to guide future efforts. The plan could also be used to monitor progress and periodically review concepts in order to ensure their currency and effectiveness in a situation in which the analytical requirements change over time.

MOS restructuring assessment aid. The purpose of the assessment aid is to provide the combat developer with the capability to evaluate the need for performing requirements-based MOS restructuring early in the force structure change process. The ideal time for performing a restructuring assessment is during development of the O&O plan, as MOSs affected by the plan must then be evaluated in terms of MPT implications.

Often, restructuring analysis is at best a reactive rather than a proactive process because restructuring needs are not uncovered until late in the new doctrine, organization, or equipment system development process when the change is ready for fielding. This situation occurs because restructuring needs assessments are an implied (and therefore, unclear) component of early force structure development.

Requirements-based tradeoff analysis method. The purpose of the requirements-based tradeoff analysis method is to provide the combat developer with the capability for identifying and assessing tradeoffs related to requirements-based restructuring. A tradeoff method would not only have utility in requirements-based restructuring but would also have utility in operations-based restructuring as well.

In the requirements-based setting, the method may be used to identify and evaluate tradeoffs between MOS restructuring alternatives regarding MPT requirements, weapon system requirements, and MOS restructuring impacts. Particular attention often focuses on the relationships between MPT requirements and reliability and maintainability. Strategic MPT and equipment design decisions must be made during the acquisition process leading to choices about which MOSs are required and how the tasks of the MOS will be structured to support the operations and maintenance of the new weapon system.

While MPT and equipment system design tradeoffs are explicitly addressed in MANPRINT, many of the restructuring decisions are not captured by the process. For instance, the impacts on training resulting from MOS restructuring involve many tradeoffs; these include training length, student accessions, course content, and training difficulty. Other areas requiring consideration include grade structure requirements, skill level needs, and retention requirements.

The tradeoff method would be designed to identify potential tradeoff areas and provide analytical aids to determine their magnitude and significance. The introduction of these methods into the requirements-based restructuring process would result in tradeoffs being considered and made in a more systematic way. Specifically, independent and other key decision variables would be significantly reduced as a result of a comprehensive tradeoff analysis method.

MOS impact analysis method. The purpose of the MOS impact analysis is to assist the analyst in performing macro level assessments for evaluating the effect of integrating new or revised MOS structures into existing CMF and Army force structures. The steps of analysis performed in requirements-based restructuring generally focus on the relationship between the soldier and the equipment. Although these micro analyses are critical, an MOS restructuring decision made in the micro setting alone would carry along with it substantial risks that the decision will be suboptimal and that other critical MPT or equipment issues or programs, or, for example, organizational issues, could be negatively affected.

The MOS impacts analysis method would be designed to assist the analyst in performing macro level MOS integration assessments. The method would provide the capability to consider estimated MOS MPT resource requirements and support the evaluation of them against current CMF and Army MPT resource requirements and constraints. The introduction of this type method would result in the capability to identify and resolve macro level integration issues well in advance of the fielding of new equipment systems, missions, doctrine, or force structures.

Requirements-based MOS restructuring handbook. The handbook would be designed as a companion document to the MOCS Handbook. The purpose of the handbook is to provide a procedural guide for supporting the combat developer in determining the need for and performing requirements-based MOS restructuring analysis.

The handbook would be used by the doctrinal analyst for guidance in support of (1) formulating a work plan, (2) identifying and developing required analysis data, (3) identifying analysis steps and performing analytical procedures, and (4) documenting and assembling findings into required formats. The handbook would also identify where to get tools (such as the ones identified in the previous text) for performing requirements-based MOS restructuring analysis and when they should be used.

The handbook would prcvide a baseline which formalizes the requirements-based restructuring process. All other requirements-based MOS restructuring products would be developed from this baseline. Since explicit guidance for performing

requirements-based restructuring does not exist, a case study should be performed for each analytical step as a basis for developing the handbook.

MOS action plan generator. The purpose of this aid is to provide the analyst with tools to develop a requirements-based action plan. An action plan is not presently a routine procedure in a requirements-based restructuring effort at most installations.

The action plan generator would be designed to organize the combat developer's work by identifying the types and sources of data required, defining specific issues to be addressed, identifying key assumptions about the restructuring actions, and identifying the essential elements of analysis. Developing an action plan at the front-end of a restructuring analysis is very important in terms of setting an agenda and identifying the requirements of the restructuring effort.

The action plan generator would provide capabilities to ensure that all restructuring analysis requirements are addressed and to develop a timeline indicating the major milestones. The timeline would be used to manage the performance of the analysis effort.

This action plan generator would also be developed as the initial component of the MOS action plan generator recommended for use by the personnel proponent for operations-based restructuring (Akman and Haught, 1990). Once the action plan for performing requirements-based MOS restructuring is complete and issues resolved, the action plan would be handed off to the personnel proponent as a basis for developing the operations-based MOS actions required to implement the new or revised MOS.

Summary and Conclusions

This section has identified several ways in which the requirements-based MOS restructuring process may be made more quantitative and replicable. The research products identified here are not an exhaustive list of all the methods needed to improve requirements-based MOS restructuring.

With exception of the requirements-based restructuring handbook, the resources supporting this research effort are sufficient to make improvements in the requirements-based restructuring process. However, priorities are necessary to identify specific research initiatives. The important issues at this stage are to establish the parameters of a comprehensive research approach and to demonstrate, through at least one of the initiatives, that requirements-based MOS restructuring methods can be developed to make the restructuring process more quantitative and systematic.

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Acronyms

AAE	Army Acquisition Executives
ADM	Acquisition Decision Memorandum
ALB-F	Airland Battle-Future
AMV	Armored Maintenance Vehicle
AP	Acquisition Plan
AR	Army Regulation
AS	Acquisition Strategy
ASI	Additional Skill Identifier
ASVAB	Armed Services Aptitude Battery
BCS	Baseline Comparison System
BDR	Battle Damage Repair
BMS	Battlefield Maintenance System
BOIP	Basis of Issue Plan
CBTDEV . . .	Combat Developer
CMF	Career Management Field
CS	Combat Stocks
DA	Department of the Army
DAB	Defense Acquisition Board
DEPMEDS . . .	Deployable Medical Systems
DoD	Department of Defense
DoDI	Department of Defense Directive
DT&E	Developmental Test and Evaluation
ECA	Early Comparability Analysis Equipment
FSD	Full Scale Development
FUED	First Unit Equipped Date
HARDMAN . . .	HARDMAN Comparability Analysis
HFE	Human Factors Engineering
HQDA	Headquarters Department of the Army
LRIP	Low Rate Initial Production
LRU	Line Replaceable Units
M-CON	Manpower Constraints Aid
MAA	Mission Area Analysis

MAN-SEVAL . .	Personnel-Based System Evaluation Aid
MANPRINT . .	Manpower and Personnel Integration
MARC	Manpower Requirements Criteria
MATDEV . . .	Materiel Developer
MER	Manpower Estimate Report
MJWG	Manprint Joint Working Group
MNS	Mission Needs Statement
MOCS	Military Occupational Classification Structure
MOS	Military Occupational Structure
MPT	Manpower, Personnel, and Training
MPTS	Manpower, Personnel, Training, and Safety
O&O Plan . .	Operational and Organizational Plan
OTF	Operational Testing Feasibility
P-CON	The Personnel Constraints Aid
PC	Personal Computer
PM	Project Managers
POM	Program Objective Memorandum
QQPRI	Qualitative and Quantitative Personnel Requirements Information
ROC	Required Operational Capability
RRV	Rapid Recovery Vehicle
SIMOS . . .	Space Imbalanced MOS
SPARC	The System Performance Reliability and Maintainability (RAM) Criteria Aid
T-CON	The Training Constraints Aid
TAD	Target Audience Descriptions
TDNS	Training Device Needs Statement
TFT	Technical Feasibility Testing
TMDE	Test Measurement and Diagnostic Equipment
TOE	Table of Organization and Equipment
TRA	Training Requirements Analysis
TRADOC . . .	Training and Doctrine Command
TT	Technical Test
TTHS	Trainees, Transients, Holdees, and Students
UT	User Testing